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SEASONAL DYNAMICS OF THE SUCCESSION SERIES AT THE KÖRÖS FLOOD-PLAIN LEADING TO THE ASSOCIATION OF THE ECHINOCHLOO-HELEOCHLOETUM ALOPECUROIDIS (RAPCS 27) BODRK. 82.

I. BAGI and GY. BODROGKÖZY

Attila József University, Department of Botany, Szeged, Hungary

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Studies were accomplished during the course of the years 1982—1983 on the phytocenosis succession series at the Körös flood-plain, leading to the development of a mud-plant stand in the residual borrow-pit of an earth mine, having various hydroecological demands and being inundationresistant. Depending on the duration of inundation at the various zones, the succession series of the following cenoses developed at the borrow-pit: *Alopecurus pratensis — Poa trivialis — Potentilla reptans-Xanthium italicum — Eleocharis palustris — Agrostis stolonifera-Xanthium italicum — Carex gracilis — Heleochloa alopecuroides.*

The representatives of *Carex gracilis, Eleocharis palustris, Xanthium italicum, Agrostis stolonifera* and *Heleochloa alopecuroides* were selected for evaluation in the constructed co-ordinate system along the straight lines intersecting the certain mosaic complexes. To elucidate the hydroecological relations of the various phytocenoses as well as the physical and chemical erlations of their soil, segment disclosures and laboratory studies were performed according to stands. On the basis of the evaluation of the succession series, tight relationship could be determined between the Heleochloa alopecuroides stands and the Bidention associationgroup. Since in the root-zone of their soils only slight — and at the same time diluted sodium salt accumulation was demonstrable, their linkage to the Cypero-Spergularion SLAVNIĆ 48 is not probable.

Introduction

The phytocenological and environmental-biological investigations on the mud-plant associations can be held as being wide-spread both in Hungarian and European relations. Studies in this concern have been reported from the Saxon territories by LIBBERT (1930), by UHLING (1939), by POLI and TÜXEN (1960), by HORVATIC (1931) from Kroatia and Slavonia; a comprehensive study was provided by KLIKA (1935) and later by HEJNY (1962). The essays on mud-plant associations written by LOHMEYER (1950), VICHEREK (1962), were followed in the seventies by GUTTE (1972), HEINRICH (1973), HILBIG and JAGE (1972), JAGE (1972), as well as MARKOVIC (1975). Regarding Europe, the summaries and critical evaluations of these associations were provided by PIETSCH (1963, 1966—1967) and PIETSCH and MÜLLER—STOLL (1968).

The complex environmental-biological evaluation of these is known from the basic studies by ELLENBERG (1952).

The publications by UBRIZSY (1948) and BODROGKÖZY (1958) deal with their stands occurring in Hungary, in respect to the mud vegetation of the culture areas. The published data (TÍMÁR 1950, TÍMÁR—BODROGKÖZY 1969, BODROGKÖZY 1982) on the results of studies carried out at the river beds and backwater banks of the Tisza-valley are those which stand the closest to the present topic.

In environmental-biological relations the TWR numbers determined by ZÓLYOMI et *al.* present the basis for the grouping of the various species into units. Their classification according to hydroecological units has also been performed, the details of which have been published during the course of the processing of the Mártély Environment Protection Area (BODROGKÖZY 1982).

The cenosystematic summary and evaluation respectively, of the mud-plant associations (Isoeto—Nanojuncetea) occurring in Hungary has been accomplished by PIETSCH (1973).

Materials and Methods

The possibility and suitable area respectively, for studying the development, course of succession and seasonal dynamics of the *Echinochloo-Heleochloetum alopecuroidis,* as mud-plant association, was found along the Körös, one of the affluents of the Tisza river. Namely, a 50 m long, 10 m wide and 2,20 m deep borrow-pit remained behind many decades ago from earth extraction at the left side of the river flood-plain situated 1 km from the barrage at Békésszentandrás. The grade differences developed due to the progressive alluvial deposit seemed suitable for performing these studies (Fig. 1), since as the consequence of the barrage functioning, the water level of the dip, and together with this, also the underground water level of the Körös flood-plain showed strong fluctuation. At the time of the rise of the river, there is also a simultaneous increase in the water level of the borrow-pit, therefore it is a most frequent phenomenon that their common water surfaces develop at the flood-plain. Nevertheless, the decrease in the water level of the Körös is not followed by the rapid lowering of the water level at the dip. Therefore, even a variation of 4—5 m in water surface may develop between the two water levels.

The inundation of various periods and duration developing after the subsidence, results in the development of vegetation zones having different species compositions. The mosaic system of the cenosis-complexes reflecting the various environmental-biological, and first of all, the hydroecological relations may also develop within various zones due to the differing smaller and durable inundations. By studying these, knowledge could be gained on the environment, species composition and succession-course of the *Echinochloo-Heleochloetum alopecuroidis,* along the Körös. During the course of investigations on the various vegetation zones at the dip allocated for studying, soil profiles were also explored parallel with the preparation of phytocenological pictures. During the course of the laboratory analysis of the collected soil samples (BALÁZS, DÉKÁNY and PATZKÓ) the soil granule fractions were also determined by hydrometric method. The organic matter content was measured with the help of dichromatic method and the hy value was calculated in air space with determined vapour content with the method of K. SIK. The calcium carbonate, pH and total salt contents were also determined with potentio-metric methods.

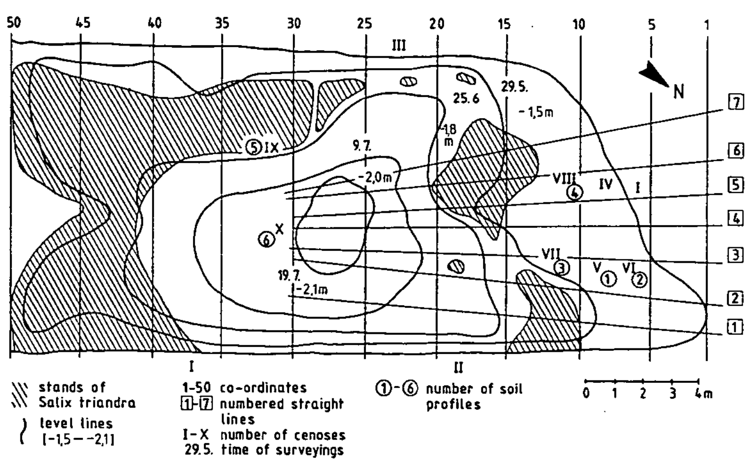


Fig. 1. Map of the studied Körös flood-plain borrow-pit residue, showing the designated co-ordinate system and the study site.

The percental distribution of the hydroecological characteristics of the various phytocenoses according to their areal quota could be determined after drawing the hydroecological graphs of the various species components (Bodrogközy 1982). The results of the soil- and hydroecological studies regarding the various plant stands are demonstrated on three-dimensional diagrams, for the sake of better reviewing and comparison.

On the constructed phytocenological tables the species were grouped in the sequence of their affiliation according to hydroecological categories. Apart from this, the F values appearing in the work of Soó as well as the W values of Zólyomi et al. were also presented. The various cenoses were labelled with Roman numbers from I—X., which can also be found on the sketch of the vegetation map.

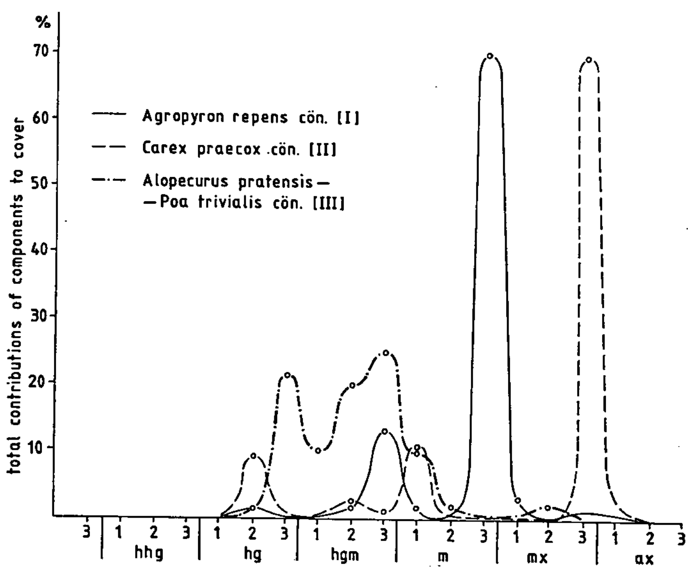
The different cenoses at the studied areas form mosaic complexes in compliance with the environmental differing effects, which are characterized by the continuity of the inundation of the various species components. These complexes were intersected by 7 straight lines (Fig. 1), on which the curves of the various inundation values are demonstrated. The inundation values are not co-ordinated to the complete intersection, but only to its focus. The co-ordinates of these can be found on the upper part of the map sketch, and are illustrated on the abscissa in the case of the graphs. In such manner, curves were obtained which can easily be interpreted and are descriptive.

Detailed evaluation

1. The environs of the studied area

The environment of the phytocenoses forming the zones of the borrow-pit selected for study may serve for the controlling of their association- and environmentalbiological relations. A discontinued tillage is located South-East from the area, directly at the border of the dip. The strongly devastated cenoses of the *Agropyron repens* (I) and the *Carex praecox* (II) are situated here. Several representatives of the Agropyro-Rumicion and Calystegion can be found among their species components (Table 1).

From hydroecological point of view, the analysis of the No. I. cenosis evidenced a 70% total covering quota for the mesophyton — in particular, the species from the



Fib. 2. Comparative hydroecological curves of the phytocenoses circumscribing the dip.

Table 1. *Cenoses of the Agropyron repens (I) and the Carex praecox (II)*

Water demand F	Water demand W	Hydroecological character	species / Character Species	Cenosis: / Total covering: / Area (m²):	I	II
				Total covering:	100	100
				Area (m^2):	6	4
			Helo-hygrophyton:			
4—5	9	*hhg1*	*Lycopus europaeus*	Phragmitetea		
			Hygrophyta:			
3—4		*hg1*	*Glycyrrhiza echinata*	Calystegion		
4—5	8	*hg2*	*Ranunculus repens*	Agr.-Rumicion		
3—4	7	*hg2*	*Tanacetum vulgare*	Calystegion		
3		*hg2*	*Rorippa sylvestris*	Agr.-Rumicion		
			Hygro-mesophyta:			
3—5	8	*hgm2*	*Rubus caesius*	Salicetea		
3—4		*hgm2*	*Amorpha fruticosa*			
3	4	*hgm3*	*Aristolochia clematitis*	Calystegion		
2—3	5	*hgm3*	*Rumex crispus*	Agr.-Rumicion		
			Mesophyta:			
0	4	*m1*	*Cirsium arvense*	Chen.-Scleranthea		
2—3	3	*m3*	*Agropyron repens*	Agr.-Rumicion		
			Meso-xerophyton, Asteno-xerophyton:			
2—3	3	*mx3*	*Carex praecox*	Festuco-Bromea		
2	2	*ax1*	*Festuca pseudovina*	Festucion pseudov.		

symbols: D-value
- 50—100%
- 25—50%
- 5—25%
- 1—5%
- 0,5—1%

(The symbols apply to table 1—5)

m3 category unit — on the plots taken on May 28, 1983. Similarly high values were detected from the No. II. cenosis; from here, on the line of the *mx3* subunit of the meso-xerophyton category (Fig. 2).

The Western- and South-Western border of the dip was found to be covered by the *Alopecurus pratensis — Poa trivialis* cenosis. Its soil- and relief relations respectively, are closely similar to the previous, nevertheless, the less termophilic species have become dominant. The cause of this is the *Salix alba — Populus nigra* gallery-forst situated nearby, with a tremination of 75%. Its shading effect has evidently resulted more favourable hygroecological relations. Regarding the total covering quota of the species of this cenosis per category, great difference was observed compared to the No. I. and II. cenoses. Its drawn curve shows two significant maximums: on the *hgm3* line within the hydromesophyton category, and on the *hg3* line within the hygrophyton, respectively (Fig. 2). The Molinietalia and Molinio-Arrhenatherea representatives are dominant from cenosystematic point of view (Table 2).

The regular succession studies were started on May 28, 1983. By this time, the decrease in water level at the borrow-pit made possible the development of the *Potentilla reptans — Xanthium italicum, Eleocharis palustris, Carex gracilis, Agrostis stolonifera — Xanthium italicum* cenoses.

Table 2. *Cenoses of the Alopecurus pratensis — Poa trivialis (III)*

Water demand F	Water demand W	Hydroeco-logical character	Species	Character species	Cenosis: Total cove-ring: Area (m²):	III 100% 10
			Hydato-helophyton: Helo-hygrophyton:			
3—4	10	*hhe2*	*Typhoides arundinacea*	Phragmitetea		
3	8	*hhg3*	*Agrostis stolonifera*	Agr.-Rumicion		
			Hygrophyta:			
3—4	7	*hg1*	*Carex hirta*	Mol.-Arrhenatherea		
4—5	8	*hg1*	*Symphytum officinale*	Molinietalia		
3—4		*hg1*	*Glycyrrhiza echinata*	Calystegion		
3—4	6	*hg2*	*Potentilla reptans*	Agr.-Rumicion		
3—4	9	*hg3*	*Poa trivialis*	Mol.-Arrhenatherea		
3—4	8	*hg3*	*Thalictrum lucidum*	Molinietalia		
			Hygro-mesophyta; Mesophyton:			
3	5	*hgm1*	*Alopecurus pratensis*	Mol.-Arrhenatherea		
4	5	*hgm1*	*Althaea officinalis*	Agrostion		
3—5	8	*hgm2*	*Rubus caesius*	Salicetea		
3	4	*hgm3*	*Aristolochia clematitis*	Calystegion		
3—4		*hgm3*	*Amorpha fruticosa*			
2—3	3	*m3*	*Agropyron repens*	Agr.-Rumicion		

Table 3. *Cenosis of the Potentilla reptans — Xanthium italicum (IV)*

Water demand F	Water demand W	Hydroeco-logical character	Species	Character species:	Cenosis Total covering: Area (m²)	V 100% 6
			Helophyton, Helo-hygrophyton:			
4—5	9	*he3*	*Lycopus europaeus*	Phragmitetea		
2—3	8	*hhg3*	*Agrostis stolonifera*	Agr.Rumicion		
			Hygrophyta:			
3—4	8	*hg1*	*Symphytum officinale*	Molinietalia		
2—3	6	*hg2*	*Potentilla reptans*	Agr.-Rumicion		
3—4		*hg2*	*Rorippa sylvestris*	Agr.-Rumicion		
			Hygro-mesophyta:			
3—4	5	*hgm1*	*Mentha arvensis*	Molinietalia		
3—4		*hgm1*	*Xanthium italicum*	Bidentetea		
3	7	*hgm1*	*Plantago major*	Plantaginetea		
2—3		*hgm2*	*Amorpha fruticosa*			
4	4	*hgm3*	*Aristolochia clematitis*	Calystegion		
			Mesophyton:			
2	3	*m3*	*Agropyron repens*	Agr.-Rumicion		

It can be seen from Figure 3 that the water still covers the major part of the *Salix triandra* zone. At the area becoming dry 1—1 zone standing of the *Carex gracilis* or *Eleocharis palustris* cenosis can be found. The zones of the *Carex gracilis* and the *Eleocharis palustris* cenoses near the water show coincidence; one or the other plant species occurs with prominent covering. The first straight line shows that the *Carex gracilis* cenoses form two zones. The *Xanthium italicum* and the *Agrostis stolonifera* do not form zones, their covering values do not have any pronounced maximum points; these values are similar to each other.

Potentilla reptans — *Xanthium italicum* cenosis (IV)

Its transitional stand developing at the North- North-Western section of the area could be found in deeper location than the surrounding relief, but it was only exposed to a more prolonged water covering for short period. However, during the norming hours, this stand is exposed to more enhanced isolation. On the effect of these environmental conditions, in its grass-plot, those of *hg2* character from the hygrophyton representatives and the *Potentilla reptans* belonging to the Agropyro-Rumicion were dominating. Nevertheless, at the same time, the number of the hygro-mesophyton species components was also significant (Table 3).

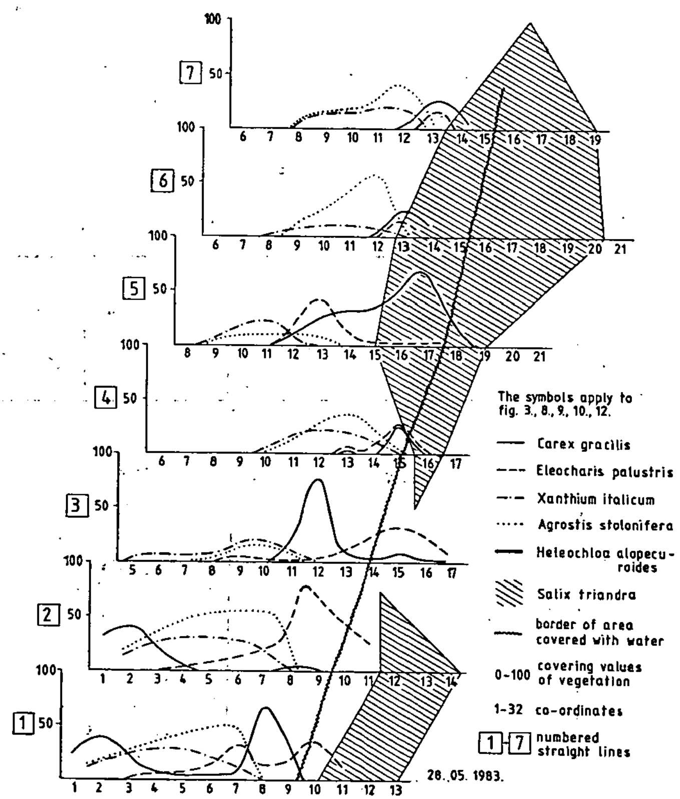


Fig. 3. Percental changes of the mosaic-complex-like covering of the selected species within the designated co-ordinates (May 28, 1983).

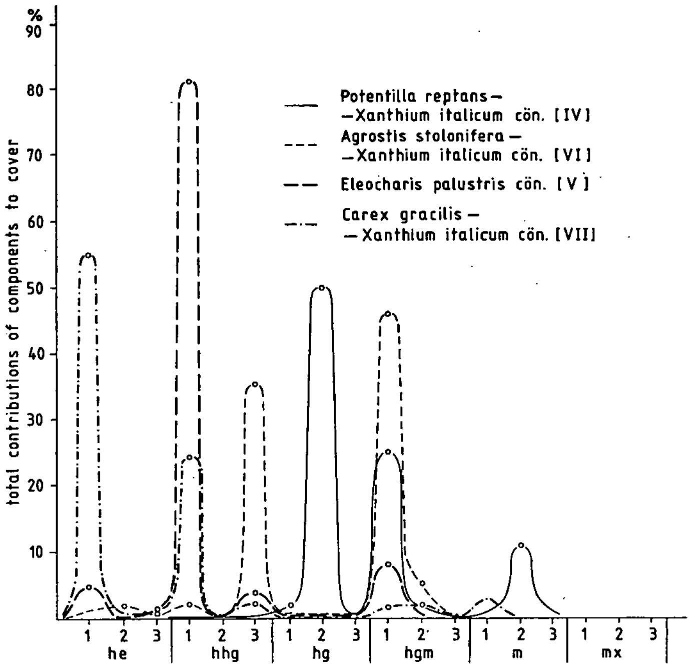


Fig. 4. Comparative hydroecological diagram of the four cenoses.

(V) *Eleocharis palustris* cenosis

The previous cenosis was followed by a section of more wider relief, which was in average about 1,5 m deeper than the environs of the borrow-pit. Even within the zone itself, smaller-larger relief differences appeared. Here, the smaller dips are also filled with stagnant water for longer periods, since their soil is permeable to water in a less degree. Therefore, the *Eleocharis palustris* cenosis developed here, belonging to the helo-hygrophyton category.

Cenological relations:

The species components of the stand belong to the *hhg1* subgroup, and represent a transitional character towards the *he3*-s. Nevertheless, certain perennial species — although with subordinate role — may also appear in their grass-plot, like the *Lythrum salicaria, Lycopus europaeus, Agrostis stolonifera,* which also are the members of the hhg category. The *Xanthium italicum* — the representative of the Bidentetea from the hygro-mesophyton category — also attains place for itself here, due to its being more agressive and having more enhanced adaptability. Concerning the affiliation of their stand, evaluating the total covering quota of their species, they have by far dominating role on the *hhg* 1 line (Fig. 4., Table 4).

Soil relations:

The soil segment of the cenosis originating from the place shown on the map of Figure 1 is found to be the most bound in the root zone from the viewpoint of phy-

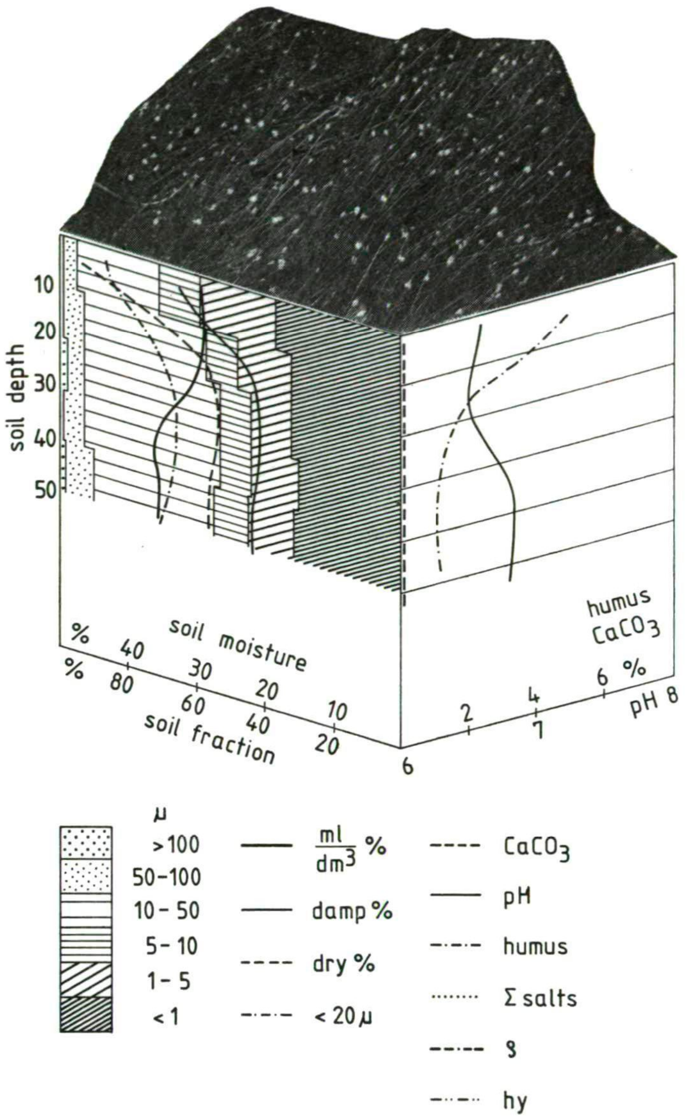


Fig. 5. The soil-ecological relations of the *Eleocharis palustris* stand (May 28, 1983).

sical composition, as shall also be experienced in the case of the cenoses to follow. This is referred to by the percental distribution ratio of the clay and mud fraction, compared to the sand fraction. The difficulty of penetration into the lower soil layers of the periodical water covering the surface can be attributed to this. Its values expressing hydrolytic acidity are balanced. Its organic matter content shows steady decrease towards the lower layers, hidden humus layer could not be determined. Further details are observable on Figure 5.

Agrostis stolonifera — Xanthium italicum cenosis (VI)

The next stand showing mosaic-like development could be found in an area having a somewhat more abrupt slope than the previous one, thus in environmental-ecological respect, it differs from the species components of the *Eleocharis palustris* cenosis.

Table 4. *Cenoses of the Eleocharis palustris (V), Agrostis stolonifera — Xanthium italicum (VI) and Carex gracilis (VII)*

Water demand		Hydroeco-logical character	Species	Character species	Cenosis: Total covering % Area (m²)	V 98 5	VI 100 10	VII 90 5
F	W							
			Helophyta:					
4	10	*he1*	*Carex gracilis*		Caricion gracilis			
3—4	9	*he2*	*Lysimachia vulgaris*		Phragmitetea			
4—5	9	*he3*	*Lycopus exaltatus*		Phragmitetea			
			Helo-hygrophyta:					
4—5	10	*hhg1*	*Eleocharis palustris*		Mol.-Juncetea			
4	9	*hhg1*	*Lythrum salicaria*		Mol.-Juncetea			
4—5	9	*hhg1*	*Lycopus europaeus*		Phragmitetea			
3	8	*hhg3*	*Agrostis stlonifera*		Agr.-Rumicion			
3—4	9	*hhg3*	*Bidens tripartita*		Bidentetea			
4	8	*hhg3*	*Lythrum virgatum*		Alopecurion			
4—5	10	*hhg3*	*Iris pseudacorus*		Phragmitetea			
4	9	*hhg3*	*Juncus compressus*		Agrostion			
			Hygrophyta:					
4—5	8	*hg1*	*Symphytum officinale*		Molinietalia			
3—4	6	*hg2*	*Potentilla reptans*		Agr.-Rumicion			
3		*hg2*	*Rorippa sylvestris*		Agr.-Rumicion			
			Hygro-Mesophyta:					
3		*hgm1*	*Xanthium italicum*		Bidentetea			
3—4		*hgm1*	*Mentha arvensis*		Molinietalia			
2—3	7	*hgm1*	*Plantago major*		Plantaginetea			
0	8	*hgm2*	*Rubus caesius*		Salicetea			
3—4		*hgm2*	*Amorpha fruticosa*					
			Mesophyta:					
0	4	*m1*	*Cirsium arvense*		Chen.—Scle-ranthea			
3—4	6	*m1*	*Inula britannica*		Plantaginetea			

Cenological relations:

Regarding the total covering quota of the species of the stand, two more significant culmination points from the hygro-mesophyton to the helohygrophyton category can be observed on the drawn curve (Fig. 4).

Soil relations:

The study results are shown on the diagram of the 2nd explored segment. Although being similar to the previous structures, here the harmful salts are demons-

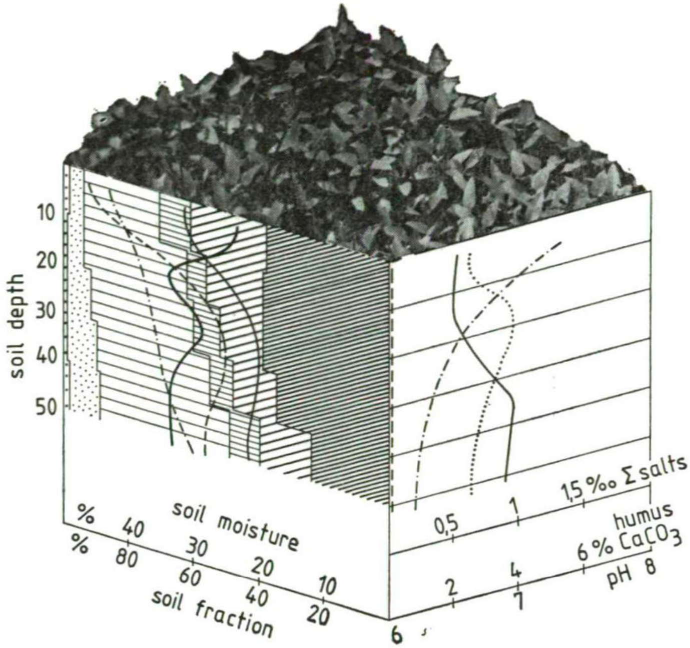


Fig. 6. The complex-mosaic soil profile of the *Agrostis-Xanthium*.

irable, coming close to 0,10% in the lower soil layers. On its effect, however, since tt hardly reached the lower limit of the salinity grade, no halophyton species were found among the species components (Fig. 6., Table 4).

Carex gracilis cenosis (VII)

At the same relief area, but in slightly greater patches the stagmant water exerted its effect for a shorter period. Due to this, the dominating species were the *Carex gracilis* stands and not the one year old species. Since no significant changes were observed in the soil segment, — neither during the course of physical, nor chemical analysis, — the short period of water covering presumably showed favourable effect on the development of this sedgy stand (Fig. 7., Table 4).

Figure 8 demonstrates the conditions of 25th June. The changes in covering of the representative plant species can also be seen from the Figure (Fig. 8). Within the period of 1 month, the water level decreased to such an extent that the complete *Salix triandra* zone came to dry surface. Newer *Eleocharis palustris* or *Carex gracilis* zones developed within the *Salix* zone. From outside, the *Xanthium italicum* and the *Agrostis stolonifera* continuously expanded inwards, but these cannot be found within the *Salix* zone at the timepoint of plotting.

The data of the next registration was 9th July.

Essential changes: The *Xanthium italicum* appears within the *Salix triandra* zone, however, the *Agrostis stolonifera* cannot be found within. As observable on the straight line of the third registration, it is not the *Salix triandra* zone which hinders the expansion of the *Agrostis stolonifera*. In the case of the outer *Carex* and *Eleocharis*

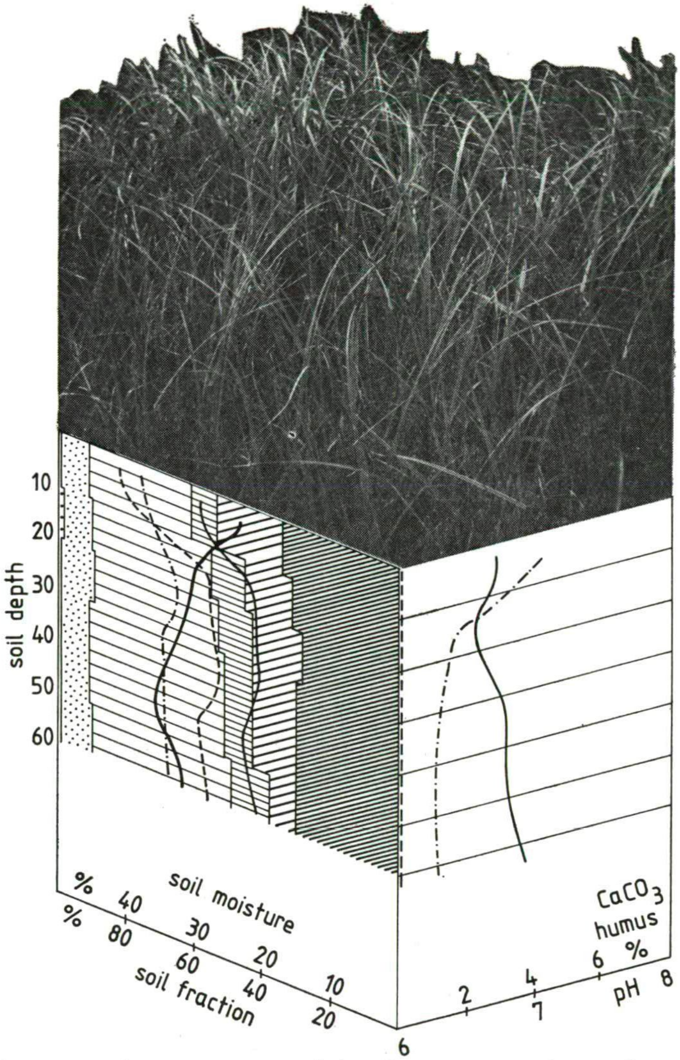


Fig. 7. The soil segment characteristics of the *Carex gracilis* cenosis (VII).

zones, a strong decrease in covering could be observed, their place being occupied by the *Agrostis stolonifera* and *Xanthium italicum* stands.

Figure 10 illustrates the central part of the studied area on July 19, 1983. Water has only remained at the deepest points. The *Heleochloa alopecuroides* shows mass germination, and the *Xanthium italicum* shows continuous expansion inwards. *Agrostis stolonifera* are still not observable within the inner areas (Fig. 10).

Figure 11 demonstrates the part of the area falling between the 30—42 co-ordinates. The photograph was taken on July 19, 1983.

By the middle of August, the vegetation occupies the complete study area. The last plotting was taken on 10th August, 1983 (Fig. 12). The studies carried out

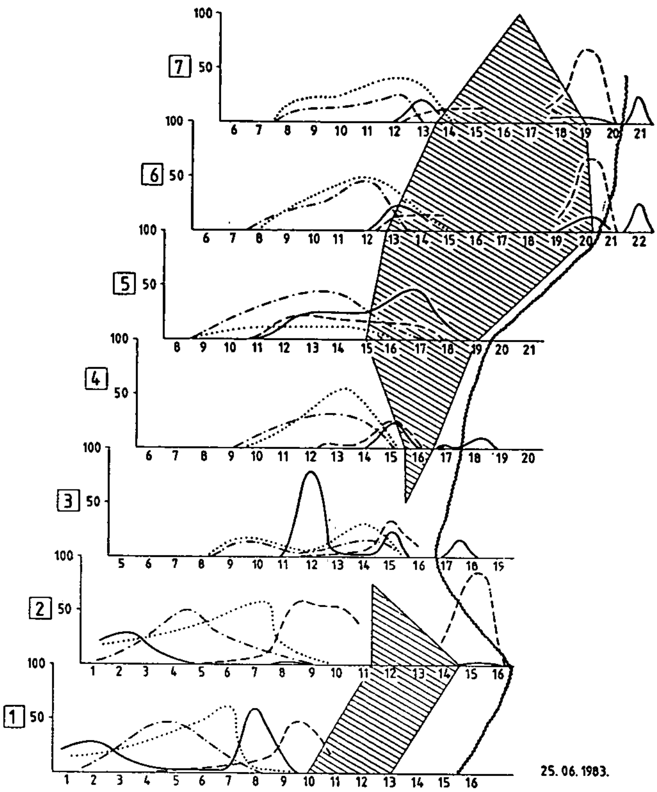


Fig. 8. The situation of the species components forming the mosaic complexes (June 25, 1983).

at later time-points did not show any essential changes in the composition of the phytocenoses. The phenomenon could be observed that pure *Heleochloa alopecuroides* stands developed at the deepest parts of the area. The expansion of the *Xanthium italicum* became slow inwards. The inner *Eleocharis* cenoses also became disorganized.

The *Xanthium italicum* even penetrated into the inner *Carex gracilis* zones. From the outer species, those were found to be the most stable, which originally possessed the slightest diversity. No amalgamation could still be detected in the case of the *Agrostis stolonifera* and the *Heleochloa alopecuroides.*

Conclusions regarding the phytocenological and hydroecological relations at the end of the vegetation period could be drawn from the studies carried out on November 5, 1982.

Agrostis stolonifera — Xanthium italicum cenosis (VIII)

The cenosis-complex labelled No. VIII. can be found at the −1,5 m relief somewhat further from those labelled Nos. V., VI. and VII. Their situation is the opposite here, contrary to the No. VI. cenosis-complex, where the culmination point of the hydroecological curve regarding the total covering quota of the *hgm1* species components was higher than those of the *hhg3.* The species being more sensitive against the covering by water for long duration — like the *Carex gracilis, Lysimachia vulgaris,* only had subordinate roles (Table 5, Fig. 13).

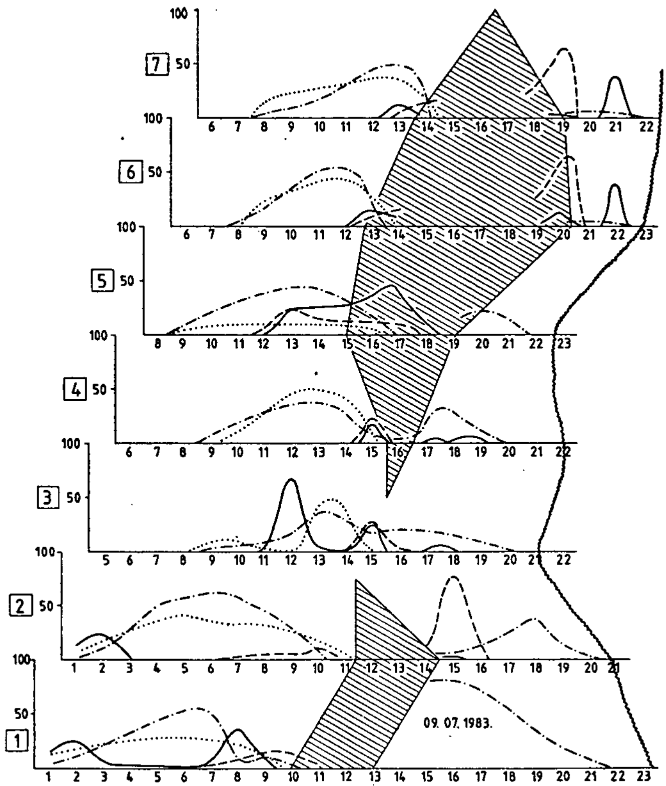


Fig. 9. The situation of the species components on July 9, 1983.

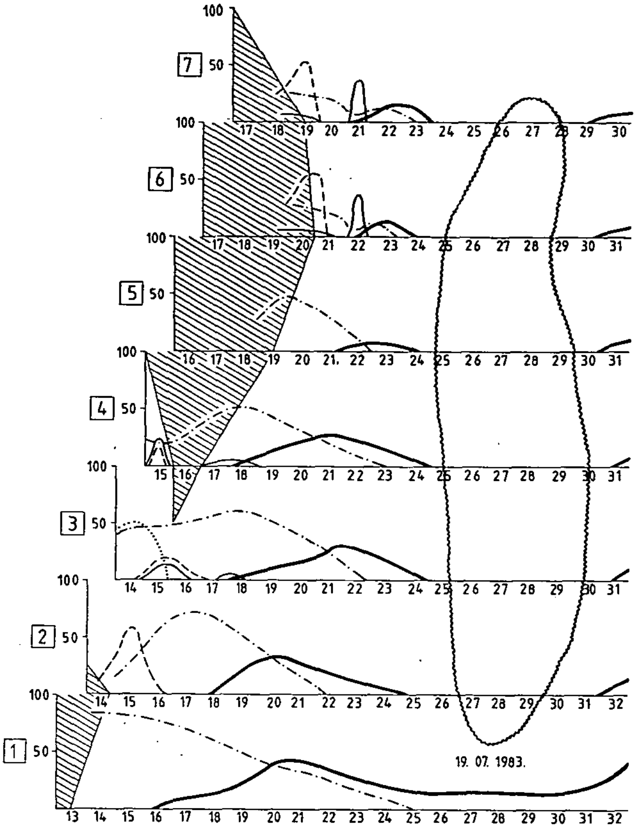


Fig. 10. Ten days later (July 19. 1983).

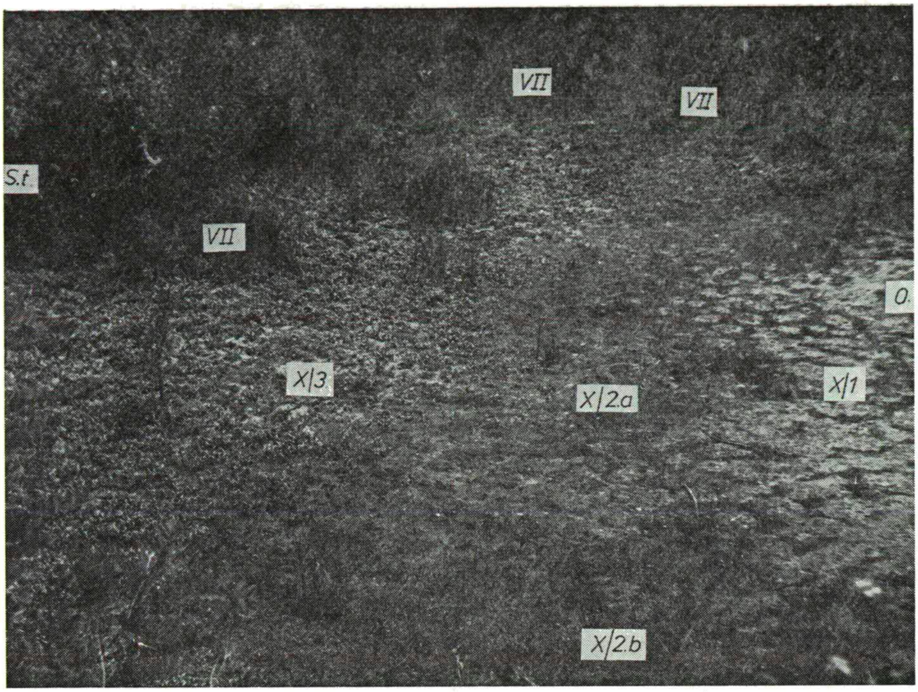


Fig. 11. Zonation system of the development of *Echinochloo-Heleochloetum alopecuroidis*
0 area still covered with water
X/1 initial stage of the appearance of the stand
X/2*a* the developed mud-grass
X/2*b* residue of *Xanthium italicum* penetrating in the earlier year into the Heleochloa alopecuroides cenosis
X/3 the boundary of this year's penetration of *Xanthium italicum*
VII complex of *Carex gracilis* cenosis
S. t. *Salix triandra* stand

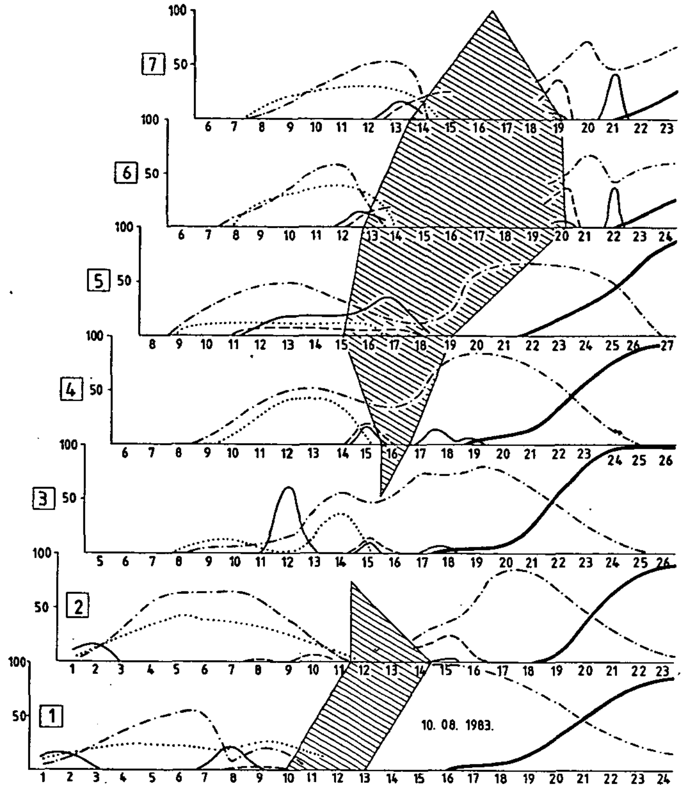


Fig. 12. Comparative percental values of the covering relations concerning the time-point August 10 1983.

Table 5. *Cenoses of the Agrostis stolonifera — Xanthium italicum (VIII, IX) and Heleochloa alopecuroides (X)*

Water demand F	Water demand W	Hydroeco-logical character	Species	Character species	VIII	IX	X
				Cenosis	VIII	IX	X
				Total covering	95	100	100
				Area (m²)	12	12	16
				Soil segment	4	5	6
			Helophyta:				
4	10	*he1*	*Carex gracilis*	Magnocaricion			
3—4	9	*he2*	*Lysimachia vulgaris*	Phragmitetea			
4—5	9	*he3*	*Lycopus exaltatus*	Phragmitetea			
			Helo-hygrophyta:				
4	9	*hhg1*	*Lythrum salicaria*	Mol.-Juncetea			
4—5	10	*hhg1*	*Eleocharis palustris*	Mol.-Juncetea			
3	8	*hhg3*	*Agrostis stolonifera*	Agr.-Rumicion			
2—4		*hhg3*	*Heleochloa alopecuroides*	Cyperio-Sperg.			
4	9	*hhg3*	*Juncus compressus*	Agrostion			
3—4	9	*hhg3*	*Bidens tripartita*	Bidentetea			
			Hygrophyta:				
3—4		*hg1*	*Glycyrrhiza echinata*	Calysregion			
3—4	6	*hg2*	*Potentilla reptans*	Agr.-Rumicion			
			Hygro-mesophyta:				
3		*hgm1*	*Xanthium italicum*	Bidentetea			
2—3	7	*hgm1*	*Plantago major*	Plantaginetea			
3—4		*hgm1*	*Mentha arvensis*	Molinietalia			
3—4		*hgm2*	*Amorpha fruticosa*				
			Mesophyta:				
2—3	3	*m3*	*Agropyron repens*	Agr.-Rumicion			

Soil relations:

From soil-physical point of view, the looser structure of the zone segment referred to its mosaic-complex-like arrangement. This could be concluded from the dominating role of the mud fraction and by the rise in the quota of sand. The moisture content was found to be essentially lower than the data measured in the Spring interval. Although harmful salts were also demonstrable here, they still did not reach the lower limit of the salinity degree. However, chalk concretions were detectable in the lower layers. The further data are demonstrated on Figure 14.

The No. 5. soil segment showed slight variation, where the boundary of covering of the *Salix triandra* was observable. Compared to the previous, higher moisture content was characteristic here. This was accompanied by the higher organic matter content demonstrable also in the lower soil layers. Although the percental values of the sodium salts reached a value of 0,10% here, it showed no effect on the species composition of the *Agrostio-Xanthietum* cenosis (IX). Nevertheless, the *Heleochloa alopecuroides* of *hhg3* nature was observable here (Table 5). The helophyton species did not show any changes.

Cenological relations:

The total covering quota of the species of this cenosis could be regarded close to similar to those of the No. VIII. cenosis (Fig. 13., Table 5).

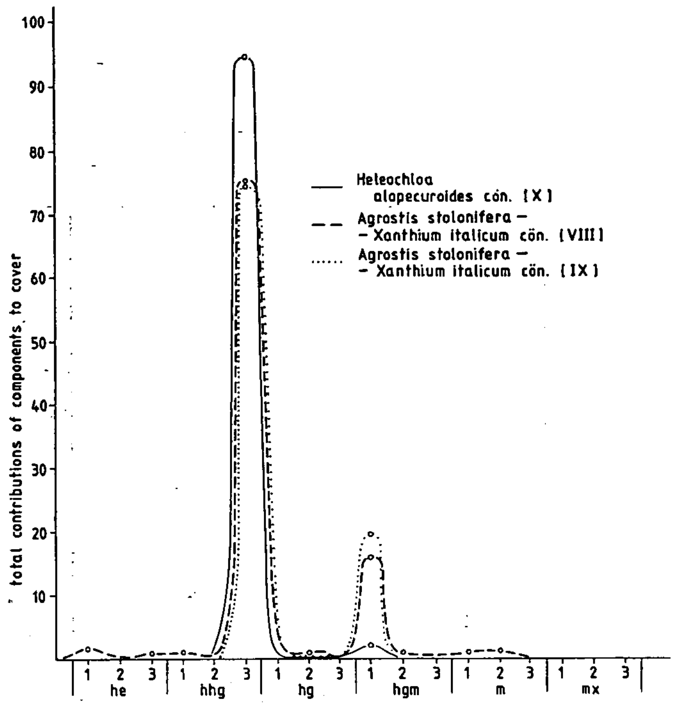


Fig. 13. Comparative hydroecological curves of the *Heleochloa alopecuroides* and the *Agrostis-Xanthium italicum* complex-cenoses.

Heleochloa alopecuroides cenosis (X)

The area located deeper than -2,1 m was no further covered by water after 19th July. At the time of the study dated 10th August, the area was covered by the blooming state of the *Heleochloa alopecuroides* cenosis as observed on Figure 15. The soil sampling was accomplished on November 5, 1982.

Cenological relations

Regarding species composition, this mud cenosis is rather poor in species, standing mostly of Cyperio-Spergularion and Bidentetea, respectively, as well as of Calistegion. The dominancy of the long-lasting surface water and the possibilities provided by the short vegetation period were firstly favourable for the *Heleochloa alopecuroides,* being of *hhg3* nature; thus having wider ecological adaptability from hydroecological point of view. The *Xanthium italicum* also showing great adaptability, and which — as mentioned earlier — could be regarded as *hgm*1 representative within the hygro-mesophyton category, had lost its dominating role, and had continuously extended towards the deeper zone. Nevertheless, the *Agrostis stolonifera* was still not detectable within this inner zone. The endurance of the *Glycyrrhiza echinata* belonging to the *hg*1 subgroup was, however, not expectable (Table 5).

Regarding the hydroecological total covering quota of the mud cenosis, the *hhg3* subunit played a role in close to 100% (Fig. 13).

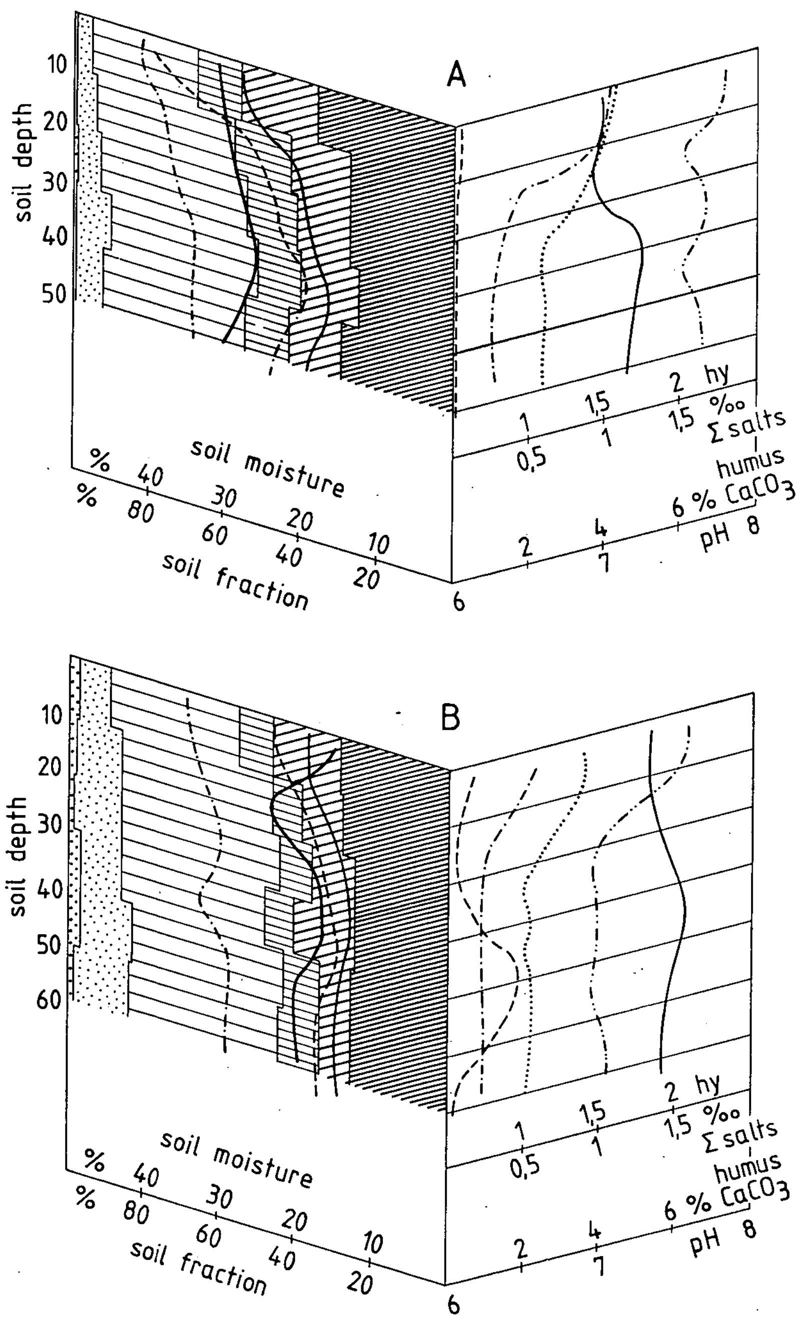


Fig. 14. The physical, chemical and hydroecological characteristic data of the A (VIII) and B (IX) soil segments of *Agrostis stolonifera* — *Xanthium italicum.*

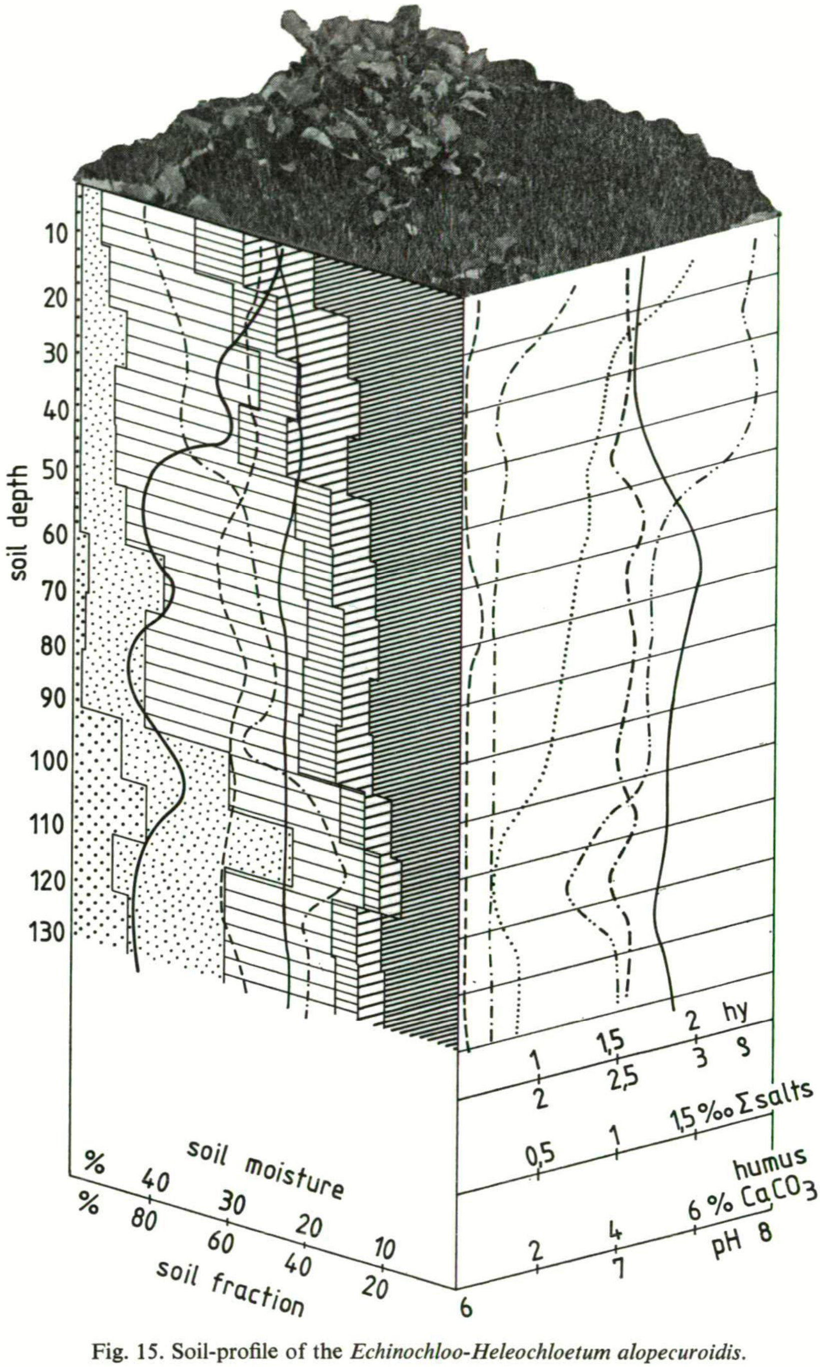


Fig. 15. Soil-profile of the *Echinochloo-Heleochloetum alopecuroidis*.

Soil relations:

In this cenosis, the 130 cm deep segment reflects well the development of the explored soil profile of the borrow-pit residue excavated more than 50 years ago at the Körös flood-plain. Its gradual siltation is well followable. While the upper 40 cm level of the segment — besides the significant clay fractions — is dominantly mud; progressing downwards, smooth sand combined with a fraction of rough sand becomes dominating. This was also reflected by its moisture-retaining ability. Otherwise, the water content referring to the mass of the soil can mainly be regarded as constant in the segment. The pH of the soil is close to neutral (Fig. 15). The calcium carbonate content is not significant, at the same time, in the upper part of the root zone, a higher — 0,144% — salt content could be determined compared to the previous. Taking into account the moisture relations of the area, it could be determined that it had no effect on the composition of the species components in such diluted state; apart from the *Heleochloa alopecuroides,* no other halophyton occurred.

The lack of other halophyta, the close to neutral chemical reaction of the soil makes the relationship between the *Heleochloa alopecuroides* cenoses and the Cypero-Spergularion association-group doubtful; at the same time, the process of the sucession, and the constant occurrence of the Bidentetea character species refer to the belonging to the Bidention association-group.

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Az Echinochloo—Heleochloetum alopecuroidis (Rapcs. 27) Bodrk. 82. társulásához vezető szukcessziósor Körös-hullámtéri szezonális dinamikája

BAGI I. és BODROGKÖZY GY.

József Attila Tudományegyetem, Növénytani Tanszék, Szeged

Kivonat

A Körös-hullámtéren egy földbánya visszamaradt anyagárkában iszapnövényállomány kialakulásához vezető, különböző hidroökológiai igényű és vízelborítottságot tűrő fitocönozis szukcesszió sor vizsgálatára került sor 1982—83-ban. Az anyagárokban az egyes zónák vízelöntöttség tartósságától függően *Alopecurus pratensis-Poa trivialis*→*Potentilla reptans-Xanthium italicum*→*Eleocharis palustris*→*Agrostis stolonifera-Xanthium italicum*→*Carex gracilis*→és végül a *Heleochloa alopecuroides* cönozisok szukcesszió sora alakult ki.

A megszerkesztett koordináta rendszerben az egyes mozaikkomplexeket metsző egyenesek mentén értékelésre kiválasztott reprezentánsok: *Carex gracilis, Eleocharis palustris, Xanthium italicum, Agrostis stolonifera* és a *Heleochloa alopecuroides*. Az egyes fitocönozisok hidroökológiai, talajuk fizikai és kémiai viszonyaik tisztázására állományonként szelvényfeltárásokra, illetve laboratóriumi vizsgálatokrá került sor. A szukcessziósor kiértékelése alapján a *Heleochloa alopecuroides* állományainak szoros kapcsolata volt megállapítható a Bidention asszociáció-csoporttal. Mivel talajuk gyökérzónájában csupán enyhe és ugyanakkor felhígult nátriumsó felhalmozódás volt kimutatható, kapcsolatuk a Cyperio-Spergularion SLAVIĆ 48 felé nem valószínű.

Сезонная динамика суккцессионного ряда, ведущего к формированию сообществ Echinochloo- Heleochloetum alopecuroidis (Rapcs 27) Bodrk. в пойме р. Кëрëш (1982—1983)

И. Баги, Д. Бодрогкëзи

Кафедра ботаники Сегедского Университета им. Аттилы Йожефа

Резюме

В 1982—83 гг. в пойме реки Кëрëш во рве, образовавшемся после вывоза оттуда земли на строительство, было проведено исследование суккцессионного ряда фитоценозов с различными гидро-экологическими требованиями и способностью выдерживать покрытие водой,

которые ведут к формированию растительного состава ила. В разных зонах рва в зависимости от продолжительности покрытия водой формировался суккцессионный ряд ценозов *Alopecurus pratensis-Poa trivialis→Potentilla reptans-Xanthium italicum→Eleocharis palustris→Agrostis stolomifera-Xanthium italicum→Carex gracilis→Heleochloa alopecuroides.*

В составленной системе координат вдоль прямых, пересекающих отдельные комплексы, *Heleochloa alopecuroides*
Carex gracilis, Eleocharis palustris, Xanthium italicum, Agrostis stolonifera, Heleochloa alopecuroides.
для оценки были отобраны:

Для выяснения гидроэкологических условий фитоценозов и физических и химических условий их почвы по каждому ценозу изучали профиль почвы и делали лабораторные анализы. Как показывает ценка суккцессинного ряда, *Heleochloa alopecuroides* находились в тесной связи с ассоционной группой Bidention. Поскольку в корневой зоне их почвы можно было наблюдать лишь небольшое накопление натриевой соли, их связь с Cyperio-Spergularion *Slavnić* 48 мало вероятна.

Sezonska dinamika sukcesivnog niza Echinochloo-Heleochloetum alopecuroidis (Rapcs 27) Bodrk. 82 zajednice u plavnoj zoni Körös-a

BAGI I. i BODROGKÖZY GY.

Katedra za botaniku József Attila Univerziteta, Szeged

Abstrakt

U 1982—83. godini istraživanjima je bio obuhvaćen sukcesivni niz fitocenoze mulja sa različitim hidroekološkin zahtevima i mogućnošću podnošenja potopljenja. Ispitivanja su vršena u plavnoj zoni Körös-a, u jami nastaloj eksploatacijom zemlje. U zavisnosti od dužine trajanja plavljenja pojedinih zona, u jami je došlo do razvoja sledećeg sukcesivnog niza: *Alopecurus pratensis-Poa trivialis* → *Potentilla reptans-Xanthium italicum* → *Eleocharis palustris* → *Agrostis stolonifera-Xanthium italicum* → *Carex gracilis* → i na kraju *Heleochloa alopecuroides.*

Za analizu služile su uzorci: *Carex gracilis, Eleocharis palustris, Xanthium italicum, Agrostis stolonifera* i *Heleochloa alopecuroides,* izabrani duž pravih linija koje su u koordinatnom sistemu presecali mozaične komplekse. Utvrdjivanje hidroekoloških osobina pojedinih fitocenoza, kao i fizičko—hemijskih svojstava tla, vršeno je uzorkovanjem zajednica, odnosno laboratorijskim analizama. Na osnovu vrednovanja sukcesivnog niza, utvrdjena je tesna veza izmedju *Heleochloa alopecuoides* i Bidention grupe. Pošto se u zoni korenovog sistema u tlu javlja slaba i razblažena koncentrracija natrijumovih soli, njihova veza sa Cypero—Spergularion *Slavnić* 48 nije verovatna.